Late Holocene vegetation dynamics in response to human activities in the Teleno Mountain Range (NW Iberia)

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INTRODUCTION

- Vegetation history of NW Iberia is quite well-known due to the numerous pollen sequences published in recent decades.
- However, information about vegetation dynamics in the more continental massifs of the Cantabrian Range and adjacent mountains is quite more limited.
- In particular, fire history and its likely relationship with human activities has been scarcely investigated.
- Teleno Mountains are a good area to address these questions. Today are almost completely deforested, and it is commonly assumed that Romans were the culture responsible of this situation, as they developed important mining activities all over this mountains.
- Our main aim has been to track human impact on the landscape of this Iberian mountainous area along the second half of the Holocene and confirm the role of Roman culture in this process. For this purpose, we have obtained a new palaeoecological record from the Teleno Mountains.

MATERIAL AND METHODS

- A new core was obtained in the Xan de Llamas peat bog (42 18'15''N, 6 19'17''W, 1500 m a.s.l.)
- Four AMS dating were obtained along the sequence to establish an accurate chronological framework.
- 35 samples 0.5 cm thick were taken each 2 to 4 cm to carry out pollen and microcharcoal (> 10 μm long) analyses. Standard chemical treatment was applied to every sample.
- In addition, 28 wood and charcoal samples were recovered from several levels of the sequence. They were identified on the basis of their wood anatomy.
- We have also calculated correlation coefficients between selected pollen types (percentages) and charcoal accumulation rate (particles · cm^{-2} · yr^{-1}).

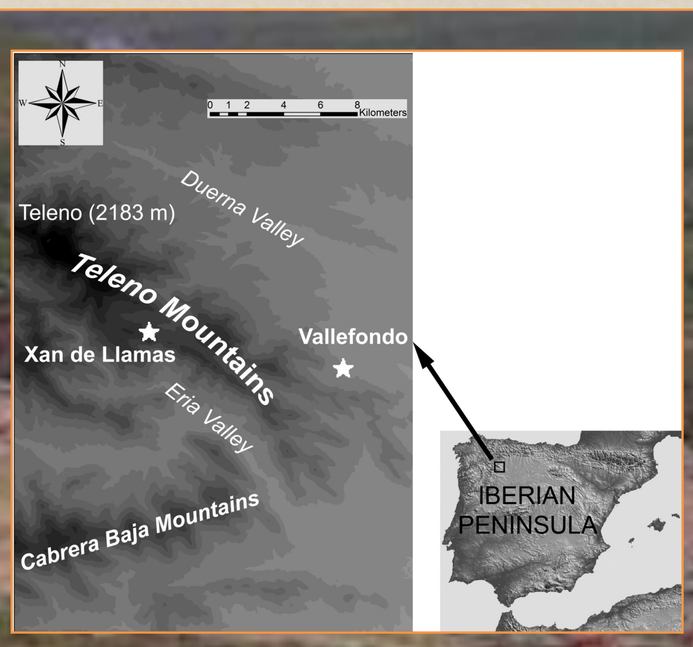

Fig.1. The Xan de Llamas site in the Teleno Mountains, NW Iberia

Depth(cm)	35-37	65	66	68	72	116	122	128
Erica sp. charcoal	5							
Betula wood		1	4	1	1			
Pinus sp. charcoal							1	2
Pinus sylvestris type charcoal						6	1	6

Table 1. Macrofossils identified in the Xan de Llamas sequence

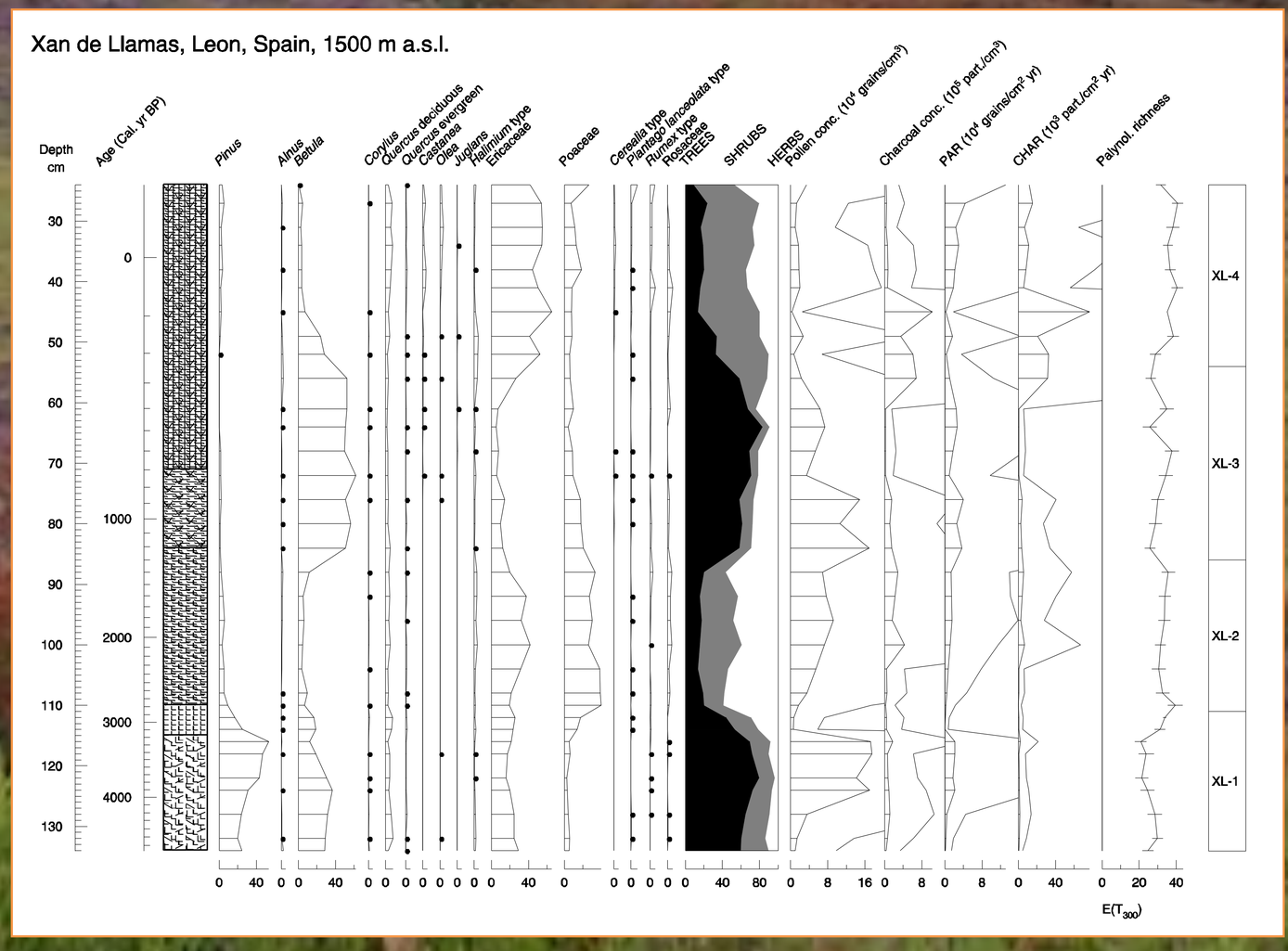

Fig. 2. Synthetic pollen diagram of Xan de Llamas

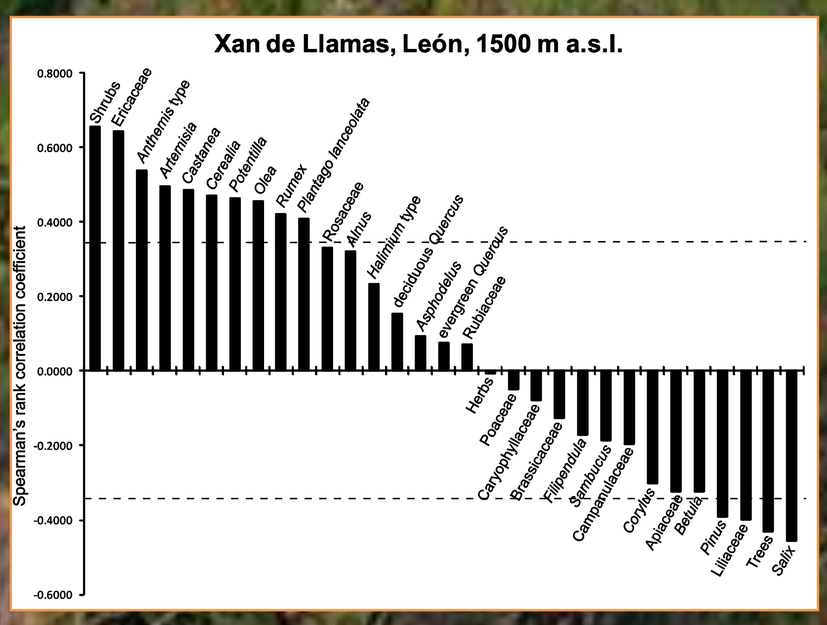

Fig. 3. Correlogram showing the correlation coefficients between selected pollen types and CHAR. Values exceding the dashed line are significant at P = 0.05

RESULTS AND DISCUSSION

- Vegetation history linked to human activities in the area presents several stages, described below:
- ❖ *Pinus* type *sylvestris* (as revealed by macroscopic charcoal analysis) and *Betula* dominated the forests that covered the upper areas of the Teleno Mountains between *c.* 2500 and 1200 BC, when a forest fire caused a strong decline of these communities. This fire could by lightning –caused or human-induced to establish pasture lands, although human settlements dating back the Bronze Age are quite scarce all around this area.
- ❖ Following this perturbation, the forest is replaced by heathlands and grasslands. These communities persisted during all the Iron Age and the Roman period, until *c.* AD 500. Thus, this area was already deforested when Romans developed the exploitation of its mineral resources. Regional fire activity increased during the Roman period maybe because the need for maintaining the areas surrounding the gold mines without vegetation cover or/and the high human population density linked to these mining activities.
- ❖ Around *c.* AD 700, *Betula* forests established in the Xan de Llamas area, probably following a decline in human occupation of these highlands.
- ❖ From AD 1600-1700 onwards, the gradual rise in regional population density may be associated to intense wildfires that triggered the replacement of birch forests with heathlands –which show a strong positive correlation with fire activity (Fig. 3)-. These wildfires and deforestation processes could be determined by increasing goat livestock in this area and the subsequent need for pastures. In fact, several pollen indicators of grazing, e.g. *Rumex*, *Plantago lanceolata* or Rosaceae, are strong and positively correlated to regional fire activity. Lastly, it is noticeable the recent increase in *Pinus* percentages perhaps reflecting the recovery of *P. pinaster* stands in the lowlands from the beginning of the XXth century linked to resin exploitation, and recent afforestations using *P. sylvestris.*